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D E C I S I O N
of 2 March 2000

Case Number: T 0301/97 - 3.2.3

Application Number: 90312414.7

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Language of the proceedings: EN

Title of invention:
Tundish impact pad

Patentee:
MAGNECO/METREL, INC.

Opponent:
I: Didier Werke AG
II: Società Bresciani Refrattari S.r.l.

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - neighbouring field"

Decisions cited:
-

Catchword:
-



Case Number: T 0301/97 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 2 March 2000

Appellant I:
(Opponent I)

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Appellant II:
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Decision under appeal:

**Decision of the Opposition Division of the
European Patent Office dated 29 January 1997,
posted on 28 February 1997, rejecting the
oppositions filed against European patent
No. 0 463 257 pursuant to Article 102(2) EPC.**

Composition of the Board:

Chairman: H. Andrä

Members: F. Brösamle

M. Aúz Castro

Summary of Facts and Submissions

- I. In the oral proceedings of 29 January 1997 the opposition division rejected the opposition of opponents I and II - appellants I and II in the following - against European patent No. 0 463 257; the written decision was posted on 28 February 1997.
- II. Claim 1 of EP-B1-0 463 257 reads as follows (typing error corrected):
- "1. A tundish vessel used in the iron and steel industry having a horizontal floor (102), a region of impact (16) on the floor and a drain (120) spaced from the region of impact; characterised in that an impact pad (10) formed from a high temperature-resistant refractory composition capable of withstanding continuous exposure to molten steel is, located on the floor (102) of the tundish vessel (100) at the region of impact (160), the impact pad (10) having a wavy upper surface (12) defined by curved protrusions which are continuous and which are configured such that substantially the entire upper surface (12) is curved provided by the protrusions in the region of the impact (16)."
- III. Against the above decision of the opposition division appellants I and II filed appeals on 15 March 1997 and on 29 April 1997, paid the appeal fee on 15 March 1997 and 5 May 1997 and filed the statement of grounds of appeal on 7 July 1997 and on 27 June 1997 respectively.

IV. Following the Communication of the board pursuant to Article 11(2) RPBA in which the board dealt with the documents

(DO) DE-A-2 643 009 and

(E3) FR-A-1 081 253

oral proceedings before the board were held on 2 March 2000 in which the proprietor - respondent in the following - submitted further sets of claims and requested that the appeal be dismissed with the proviso that the patent be maintained on the basis of claims 1 to 17, an adapted description, Figures 6 to 9, all filed on 2 February 2000 and of Figures 1 to 5b according to the patent specification as **main request**, or as granted as **first auxiliary request**, or on the basis of claim 1 filed as "auxiliary request" on 2 February 2000, claims 2 to 17 as granted, an adapted description filed also on 2 February 2000 and the figures according to the main request as **second auxiliary request**, or on the basis of claim 1 filed in oral proceedings as "new second auxiliary request" and claims 4 to 17 as granted being renumbered accordingly, a description yet to be adapted and the figures according to the main request as **third auxiliary request**, or on the basis of claims 1 to 3 filed in the oral proceedings as "new third auxiliary request" and subsidiary claims as well as a description yet to be adapted and the figures according to the main request as **fourth auxiliary request**.

V. Appellant I requested that the decision under appeal be

set aside and that the European patent No. 0 463 257 be revoked. Appellant II who was not present in the oral proceedings had by letter of 21 February 2000 forwarded the same request in writing.

VI. The independent claims of the **main** and **second to fourth auxiliary request** read as follows:

main request:

"1. The invention provides a tundish vessel used in the iron and steel industry having a horizontal floor, a region of impact on the floor, a drain spaced from the region of impact, an impact pad formed from a high temperature-resistant refractory composition capable of withstanding continuous exposure to molten steel located on the floor of the tundish vessel at the region of impact; characterised in that the impact pad has a wavy upper surface defined by continuously curved protrusions which are configured such that the entire upper surface is curved provided by the protrusions in the region of the impact."

second auxiliary request:

"1. The invention provides a tundish vessel used in the iron and steel industry formed from a refractory material and having a horizontal floor, a region of impact on the floor, a drain spaced from the region of impact, and an impact pad formed from a high temperature-resistant refractory composition located on the floor of the tundish vessel at the region of impact, and being capable of withstanding continuous exposure to molten steel, the impact pad having a wavy

upper surface defined by continuously curved protrusions which are configured such that the entire upper surface is curved provided by the protrusions in the region of the impact so that when the amount of molten steel in the tundish vessel is at a sufficient level to allow adequate separation between slag material at the surface of the molten steel and pure metal near the bottom of the vessel, the curved protrusions of the impact pad are capable of reducing the turbulence in the molten metal entering the tundish thereby resulting in less disruption of the slag layer."

third auxiliary request:

"1. A tundish vessel used in the iron and steel industry having a horizontal floor (102), a region of impact (160) on the floor, a drain (120) spaced from the region of impact, an impact pad (10) formed from a high temperature-resistant refractory composition capable of withstanding continuous exposure to molten steel located on the floor (102) of the tundish vessel (100) at the region of impact (160); characterised in that the impact pad (10) has a wavy upper surface (12) defined by continuously curved protrusions which are configured such that the entire upper surface (12) is curved provided by the protrusions in the region of the impact (160), the upper surface (12) of the impact pad (10) having curved protrusions which project upwardly alternately with curved protrusions which project downwardly such that the upper surface (12) of the impact pad (10) has a sinusoidal configuration."

fourth auxiliary request:

"1. A tundish vessel used in the iron and steel industry having a horizontal floor (102), a region of impact (16) on the floor, a drain (120) spaced from the region of impact, an impact pad (10) formed from a high temperature-resistant refractory composition capable of withstanding continuous exposure to molten steel located on the floor (102) of the tundish vessel (100) at the region of impact (160); characterised in that the impact pad (10) has a wavy upper surface (12) defined by continuously curved protrusions which are configured such that the entire upper surface (12) is curved provided by the protrusions in the region of the impact (160), the wavy upper surface varying in two directions, x and y, according to the equation:

$$v = a + b \sin (cx-d),$$

where

y represents the height of the wavy surface;

x represents the horizontal distance along the wavy surface, from back to front; and

a, b, c and d are constants which determine the configuration of the wavy surface."

and

"2. A tundish vessel used in the iron and steel industry having a horizontal floor (102), a region of impact (16) on the floor, a drain (120) spaced from the region of impact, an impact pad (10) formed from a high temperature-resistant refractory composition capable of withstanding continuous exposure to molten steel located on the floor (102) of the tundish vessel (100) at the region of impact (160); characterised in that

the impact pad (10) has a wavy upper surface (12) defined by continuously curved protrusions which are configured such that the entire upper surface (12) is curved provided by the protrusions in the region of the impact (160), the wavy upper surface varying in three directions, x, y and z; according to the equations:

$$y = a + b \sin (cx-d), \text{ and}$$

$$y = p + q \sin (rz-s),$$

where

y represents the height of the wavy surface;

x represents the horizontal distance along the wavy surface, from back to front;

z represents the horizontal distance along the wavy surface, from side to side;

a, b, c and d are constants which determine the configuration of the wavy surface in the "x" direction; and

p, q, r and s are constants which determine the configuration of the wavy surface in the "z" direction."

VII. The appellants' arguments can be summarized as follows:

(a) appellant I:

main request

- the amendment "continuously curved protrusions" of claim 1 is ambiguous and not clear and the omission of "substantially" is contrary to Article 123(3) EPC and not supported by Figure 2

of the patent specification;

- (D0) is the nearest prior art, see in particular page 10, lines 18 to 21, and page 11, second paragraph, dealing with an impact pad in a tundish vessel used in the iron and steel industry;
- (D0) deals already with splashing and with horizontal spreading of the liquid metal when hitting the impact pad i.e. with the problems discussed in EP-B1-0 463 257; in (D0) a gridlike impact pad is suggested to overcome the above negative effects in that the melt hits on the bars of the gridlike impact pad and is reflected preferably in a non-vertical direction, see arrows "7,8" in Figures 2 and 3;
- a skilled person could realize that the horizontal upper surfaces of the bars allow a vertical reflection of the melt so that they are detrimental to the reduction of vertical splashing and agitation and turbulence of the melt;
- since document (E3) also deals with the problems of splashing and spreading of molten metal hitting an impact pad a skilled person would turn to (E3) to overcome the disadvantages of (D0); from Figures 1, 3, 6 to 9 and 14/15 and corresponding text of (E3) an impact pad with a wavy upper surface is known which is defined by continuously defined protrusions; since (E3) is not restricted to ingot moulds a skilled person would combine its teaching with the teaching of (D0) to directly achieve the subject-matter of claim 1 since

identical structural features must produce identical technical effects.

first auxiliary request

- claim 1 is not sufficiently delimited over (D0) and is objectionable under Article 123(2) EPC and its subject-matter lacks inventive step.

second auxiliary request

- the omission of "substantially" in claim 1 is not possible under Article 123 EPC and the functional terms at the end of claim 1 are not clear in that they rather express a target to be achieved; the subject-matter of claim 1 is again not inventive with respect to (D0) and (E3).

third auxiliary request

- the sinusoidal configuration of the upper surface of the impact pad implicates ridges and valleys which are rendered obvious by (E3).

fourth auxiliary request

- this request was filed too late and should therefore be disconsidered; since its subject-matter was not searched the case should be remitted to the first instance; if not, the subject-matter of claims 1 and 2 does not fulfil the requirements of Article 56 EPC with respect to the combination of (D0) and (E3);

(b) appellant II:

- in view of the prior use substantiated in the opposition proceedings and the arguments brought forward with letter of 26 June 1997 the patent in suit should be revoked.

(c) respondent:

main request

- claim 1 is completely delimited over (D0); the omission of "substantially" in claim 1 removes an ambiguity and serves to clarify the claimed subject-matter without violating the requirements of Article 123 EPC, see also the term "continuously curved" of claim 1;
- (D0), see page 6, last paragraph ("Im ersteren Fall..."), is limited to a level not higher than the impact pad in contrast to a tundish vessel according to claim 1 which is so high that sufficient time is available for the separation of slag and molten metal and to avoid the inclusion of impurities in the molten metal; in contrast to (D0) it is claimed to continuously fill the tundish vessel and to maintain a high level therein to avoid turbulence and splashing;
- (E3) is published in 1954 and it is questionable whether a skilled person would consider such an old document which is based on an ingot mould and not on a tundish vessel; (E3) deals with filling the mould for the first time whereby features are

realized which are different from those claimed in claim 1, see Figure 3 and its finger-like protrusions which moreover offer **horizontal areas** to the molten metal even if the protrusions are spherical or the like so that vertical splashing can occur;

- since (D0) and (E3) deal with partly filled vessels a skilled person is not led to the subject-matter of claim 1 since even a combination of both documents would not solve the problems of reducing vertical splashing and agitation and turbulence of the molten metal.

first auxiliary request

- since claim 1 is defended in its granted version it is not allowable to raise objections under Article 123 EPC; for the reasons set out with respect to the main request the first auxiliary request is seen allowable.

second auxiliary request

- in claim 1 thereof functional terms derivable from column 4, first paragraph, of EP-B1-0 463 257 were added to claim 1 without changing its scope of protection with respect to the main request.

third auxiliary request

- claim 1 is restricted by a "sinusoidal configuration" of the upper surface, see granted claim 3; since this term is a clear definition of

the claimed shape excluding flats as in (D0) and (E3) and since this feature is not known from (D0) and (E3) claim 1 is formally in order and its subject-matter is novel and inventive.

fourth auxiliary request

- claims 1 and 2 contain formulae for the sinusoidal form of the protrusions in two or three directions which formulae cannot be seen from (D0) and (E3) even if in (E3) similar protrusions are disclosed; what has, however, to be considered is that (E3) is not based on a tundish vessel.

Reasons for the Decision

1. The appeals of appellants I and II are admissible.
2. *Amendments*
 - 2.1 Main request
 - 2.1.1 Granted claim 1 is based on protrusions "which are continuous"; in claim 1 of the main request this feature has been amended into "continuously curved protrusions". For the board this amendment is admissible within the meaning of Articles 123(2) and (3) EPC i.e. nothing is changed in the technical teaching of the claim. This is also true for the omission of "substantially" of granted claim 1.
 - 2.1.2 Appellant I based an objection on Figure 2 of

EP-B1-0 463 257 and came to the conclusion that this figure does not support "continuously curved protrusions". It has, however, to be observed that Figure 2 is a plan view of Figure 1 and that Figures 3 and 5a of EP-B1-0 463 257 clearly support "continuously curved protrusions" extending from one end to the other end of the impact pad "10".

2.1.3 Summarizing, the board comes to the conclusion that claim 1 has only been clarified within the provisions of Articles 123(2) and (3) EPC.

2.2 First auxiliary request

2.2.1 This request is based on granted claim 1. With respect to the requirements of Article 123(2) EPC it is irrelevant whether or not claim 1 is clearly delimited over (D0).

2.2.2 Granted claim 1 if found to not meet the requirements of Article 123(2) EPC, could have been attacked by appellant I in the opposition proceedings, which was, however, not the case.

2.2.3 The board is in agreement with the respondent that without his consent the requirements of Article 123(2) EPC cannot be discussed for the first time in the appeal proceedings. Granted claim 1 has therefore to be accepted by the appellants and the board as it is.

2.3 Second auxiliary request

2.3.1 As set out above under remark 2.1.1 the omission of "substantially" in claim 1 is acceptable.

2.3.2 The functional term at the end of claim 1 ("so that when the amount...of the slag layer.") is indeed derivable from column 4, first paragraph, of EP-B1-0 463 257 as argued by the respondent.

2.3.3 The functional term does, however, not add **technical** features to the claim, rather expresses targets to be achieved namely to maintain a sufficient level in the tundish vessel, to allow separation of slag and molten metal and to reduce turbulence.

2.3.4 Irrespective of the technical contribution of the functional terms of claim 1 it has to be observed that the requirements of Articles 123(2) and (3) EPC are met.

2.4 Third auxiliary request

2.4.1 Claim 1 thereof is limited to a "sinusoidal" configuration of the upper surface. Granted claim 3 is a reliable basis for this feature so that appellant's I objections are not to be followed in this respect. Based on mathematics "sinusoidal" is a clear geometrical definition of a configuration and not contradictory to "sine waves" of originally filed claim 17.

2.4.2 Claim 1 is therefore not to be objected under formal aspects, Articles 123(2) and (3) EPC.

2.5 Fourth auxiliary request

2.5.1 This request comprises two independent claims, namely claims 1 and 2; whereas claim 1 is based on the

definition of the upper surface in two directions, claim 2 is based on the definition thereof in three directions.

2.5.2 Apart from the question whether or not the claimed formulae were searched, it has to be observed that they are clearly derivable from the description of EP-B1-0 463 257, see column 4, line 55, to column 5, line 38.

2.5.3 Since the formulae of claims 1 and 2 were already contained in originally filed claims 4 to 6 and could have been searched, consequently, the board allowed the fourth auxiliary request into the proceedings, Article 114(1) EPC.

3. *Novelty*

The independent claims of all requests are based on novel subject-matter. Since the issue of novelty was not contested in the proceedings it is not necessary to deal with this issue in detail.

4. *General remarks*

4.1 Before discussing the inventive merit of the subject-matter of the independent claims of all above requests of the respondent a few preliminary remarks are necessary in this respect.

4.2 To the board's conviction any "wavy surface" implies ridges and valleys - i.e. horizontal points - and in a more general sense contrary to respondent's arguments "flat areas" since identical configurations of the

- upper surface of the impact pad must comprise identical technical features, in the present case "flat areas", see EP-B1-0 463 257, Figures 1, 3, 4b, 5a, 5b, 6, 8 to 10 or see (E3), Figures 3, 7 to 9 and 14/15.
- 4.3 Furthermore, any series of curved protrusions has to be seen as "continuously curved" and as "continuous", again contrary to respondent's findings.
- 4.4 None of the independent claims of all requests to be considered is restricted to a specific height of the tundish vessel so that this feature cannot be accepted as distinguishing the claimed subject-matter from (E3).
- 4.5 (D0), see page 10, lines 18 to 21, deals with an ingot mould ("Kokille") **and** a tundish vessel ("...Zwischenbehälters im Strangguß") so that a **skilled person** in the technical field of impact pads is well aware of ingot moulds **and** tundish vessels. (E3) is not simply restricted to ingot moulds rather to similar moulds, see title thereof ("et moules similaires...").
- 4.6 Respondent's argument based on (D0), page 6, lines 25 to 27, cannot be accepted by the board. This sentence is not at all to be interpreted such that the vessel is only to be **partly** filled. What is said in the sentence under discussion is that the impact pad is only effective as long as the level of metal is not remarkably higher than the impact pad. This statement is more or less a **triviality** since an impact pad which is covered by too much melt does no longer come into contact with the melt and is no longer effective as an **impact pad**.

4.7 From the above sentence of (D0) it is therefore not justified to conclude that in (D0) there is not sufficient time available to allow separation of slag and molten metal and time to exclude any impurities to enter into the molten metal.

5. *Inventive step*

5.1 Main request

5.1.1 The nearest prior art document is (D0) in which document the effects of splashing and horizontal spreading of the liquid metal are discussed and solved by the provision of a gridlike impact pad, see Figures 2 and 3 in particular, which configuration achieves a reflection essentially in a non-vertical direction see arrows "7" and "8" in Figures 2 and 3.

5.1.2 A skilled person using the known impact pad will realize that the horizontal upper surfaces of the bars "4" of (D0) could lead to a vertical reflection of the melt, i.e. to splashing, agitation and turbulence of the melt.

5.1.3 Starting from the impact pad for a tundish vessel according to (D0) the objectively remaining technical problem to be solved by the invention is to reduce the known horizontal areas of the impact pad.

5.1.4 The solution of this objectively remaining object is based on a wavy upper surface with continuously curved protrusions.

5.1.5 As set out in above remark 4.5 the skilled person is

also aware of impact pads in the technical field of moulds in which similar problems arise, namely splashing and spreading of molten metal hitting an impact pad provided at the bottom of a melt-containing vessel, see page 1, right-hand column, second paragraph, and page 2, left-hand column, first paragraph, as well as Figures 3, 7, to 9 and 14/15 of (E3). From (E3) it is therefore known to make use of a **wavy** configuration of the upper surface of an impact pad of a melt-containing vessel. The known wavy configuration is based on continuously curved protrusions i.e. having ridges and valleys.

- 5.1.6 Starting from (D0) and being confronted with the shortcomings thereof a skilled person would - not only could - turn to (E3) which document also deals with the general problem of how energy of metal to be filled into any vessel can be attenuated to values which are no longer harmful in use i.e. do not lead to splashing, undue agitation and turbulence.
- 5.1.7 Since identical structural features must produce identical technical effects, the combination of the teachings according to (D0) and (E3) directly achieves the claimed configuration of an impact pad and its advantageous effects.
- 5.1.8 Consequently the subject-matter of claim 1 is not based on an inventive step within the meaning of Articles 56 and 100(a) EPC so that this claim is not valid. Respondent's time argument has to be rejected since it

is not convincing under the above circumstances, namely the closely related technical fields of (D0) and (E3). (E3) is still a relevant document for the construction of an impact pad.

5.2 First auxiliary request

Since claim 1 as granted does not differ in substance from claim 1 of the main request its subject-matter lacks also in inventive step with respect to (D0) and (E3).

5.3 Second auxiliary request

The introduction of functional terms into claim 1 has to be seen as a target to be achieved rather than a technical contribution to granted claim 1 so that the above arguments with respect to claims 1 of the main and first auxiliary request are also applicable to claim 1 of the second auxiliary request, Articles 56 and 100(a) EPC.

5.4 Third auxiliary request

5.4.1 The additional feature of claim 1 of the third auxiliary request is "sinusoidal" which is a more precise definition of a wavy upper surface of an impact pad.

5.4.2 A sinusoidal configuration of an impact pad to the board's conviction is rendered obvious by Figures 8 and 9 of (E3) where a wavy configuration **without steps** is disclosed and which by a skilled person *prima facie* would be characterised as a sine form.

5.4.3 Since the protrusions of an impact pad **suffer from wear** the ideal and mathematical form of the protrusions is only a virgin estate and subject to changes, see (E3) page 1, left-hand column, fifth paragraph ("une excavation...dans le fond...").

5.4.4 A sinusoidal configuration of the upper surface of the impact pad is therefore only a novel but in combination with an impact pad for a tundish vessel not an inventive feature. Claim 1 does therefore not meet the requirements of Articles 56 and 100(a) EPC.

5.5 Fourth auxiliary request

5.5.1 Claim 1 is based on a sinusoidal configuration of the upper surface of the impact pad for a tundish vessel which considers specific geometrical parameters, namely height, horizontal distance and constants. The claimed formula may be useful to define the wavy configuration for its way of production without, however, leading to a configuration not readily derivable from (E3) and its Figure 8 for example.

5.5.2 Claim 1 does therefore not define non-obvious subject-matter with respect to (D0) and (E3).

5.5.3 Claim 2 and its formulae lead to fingerlike protrusions which *per se* are also rendered obvious by (E3) and its alternatives according to Figures 1 to 7 and 8/9 and 14/15. Again the formulae may be useful for the production of the protrusions without, however, leading to a surprising and inventive configuration with respect to (E3), Articles 56 and 100(a) EPC.

6. *Prior use*

Since none of respondent's requests is to be allowed it is not necessary to discuss the alleged prior use brought forward by appellant II.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:

The Chairman:

N. Maslin

H. Andrä